LESSON MAKER PRO

Find the Peak

Use an expression to interpret a maximum or minimum.

HIGH SCHOOL · PC.F.1.1

PC.F.1.1 "Interpret characteristics of a function defined by an expression in the context of the situation."

NAME _____ DATE _____

THE TURNING POINT

For a function written as $a(x - h)^2 + k$, the turning point is at $x = h$ and has an output of k. If a is negative, k is a maximum. If a is positive, k is a minimum.

WORKED EXAMPLE

An online clip's view rate is $r(x) = -2(x - 3)^2 + 18$, where x is hours after posting and $r(x)$ is tens of views per hour. When is the rate highest, and what is it?

VIEW RATE

Hours after posting	2	3	4
Tens of views per hour	16	18	16

1. The coefficient -2 is negative, so the turning point is a maximum.
2. The expression $(x - 3)^2$ is zero at $x = 3$, giving $r(3) = 18$.
3. Convert the rate: 18 tens = 180 views per hour.

Answer: The highest rate is 180 views per hour, 3 hours after posting.

PRACTICE 4 problems

1 A gym models daily sign-ups by $s(x) = -(x - 8)^2 + 25$, where x is days after opening. Find the peak number of sign-ups and the day.

ANSWER _____

2 A skate bowl's floor height is $h(x) = (x - 7)^2 + 11$ inches, where x is feet from one end. Find its lowest height and location.

ANSWER _____

3 A theater models ticket revenue by $R(x) = -5(x - 12)^2 + 900$ dollars, where x is the ticket price in dollars. Find the price that maximizes revenue and the revenue.

ANSWER _____

4 A food truck models daily profit by $P(x) = -x^2 + 10x + 80$ dollars, where x is tens of lunches sold. Find the greatest predicted profit and the number of lunches.

ANSWER _____

APPLY IT Show your work

1 At a school concert, profit from ticket sales is $P(x) = -4(x - 15)^2 + 400$ dollars, where x is the ticket price in dollars. What price gives the greatest profit? What is that profit?

WORK SPACE

ANSWER _____

2 In a video game, a character's height is $h(x) = -8x^2 + 24x + 7$ meters, where x is seconds after jumping. When is the height greatest, and what is it?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A weekend stream's viewers, in hundreds, are modeled by $V(x) = -(x - 9)^2 + 100$, where x is hours after noon and $0 \le x \le 6$. Someone claims the stream reaches 10,000 viewers at $x = 9$. Explain why that is not its peak during the stream, and find the actual peak.

WORK SPACE AND ANSWER

ANSWER KEY

Find the Peak

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A gym models daily sign-ups by $s(x) = -(x - 8)^2 + 25$, where x is days after opening. Find the peak number of sign-ups and the day.	**25 sign-ups on day 8.**
2	A skate bowl's floor height is $h(x) = (x - 7)^2 + 11$ inches, where x is feet from one end. Find its lowest height and location.	**11 inches, 7 feet from one end.**
3	A theater models ticket revenue by $R(x) = -5(x - 12)^2 + 900$ dollars, where x is the ticket price in dollars. Find the price that maximizes revenue and the revenue.	**A $12 ticket price gives a maximum revenue of $900.**
4	A food truck models daily profit by $P(x) = -x^2 + 10x + 80$ dollars, where x is tens of lunches sold. Find the greatest predicted profit and the number of lunches.	**The greatest predicted profit is $105 at 50 lunches.**

PART 2 · APPLY IT

1. **A $15 ticket price gives a greatest profit of $400.** The squared term is zero at $x = 15$. The negative coefficient makes $P(15) = 400$ the maximum.
2. **The greatest height is 25 meters after 1.5 seconds.** The turning point occurs at $x = -24/(2(-8)) = 1.5$. Then $h(1.5) = -8(1.5)^2 + 24(1.5) + 7 = 25$.

CHALLENGE

The stream ends at x = 6, so x = 9 is outside the allowed time. Viewership rises throughout the stream and reaches V(6) = 91 hundreds, or 9,100 viewers, at x = 6.

Accept equivalent wording that gives each value with its context and units. For the challenge, the explanation must note that $x = 9$ is outside the allowed interval.